NOTES ON THE U. S. GEOLOGICAL SURVEY.

The United States Geological Survey has recently changed, somewhat, its plan of publication. For several years the Director's Report, with accompanying papers and a review of mineral resources, has filled several large volumes annually. Hereafter the Director's Report will be confined to one volume, and a series of unbound Professional Papers of quarto size will be issued. The Mineral Resources will appear separately in ordinary octavo, as also the series of Bulletins designed to place promptly before the public matters of economic and scientific interest. There is continued, also, the series of Water-Supply and Irrigation Papers. All of the above are open to free distribution by the Survey and by Members of Congress. The folios, atlases, and monographs will, as usual, be sold at the cost of publication. Circulars and maps giving lists of publications, and showing the progress of the topographic survey, may be had on application to the Director of the Survey.

Of the Water-Supply and Irrigation Papers, Nos. 65 to 79 have recently been received. This series does not contain all of the material on these subjects that is issued by the Survey. Extended reports on hydrography and on various aspects of irrigation have made part of the annual reports for several years.

No. 76 of the series named above is by Mr. H. A. Pressey, and gives a review of observations on the flow of rivers in the vicinity of New York City (108 pp., 1903). From 1890 to 1900 the use of water-power in the United States increased 30 per cent., or nearly one-half million horse-power. This fact alone shows the value of quantitative study of our streams. The case of Austin, Texas, is cited by the author. A power plant was there built at a cost of $1,600,000, and it was then found that the flow of water fell 500 per cent. below the estimate. In one instance in New York State five engineers gave in their results, making the minimum flow vary as one to two.

Possible water supply for New York City is noted in the light of ascertained conclusions—namely, that Lake George is inadequate, that Lake Champlain is too low for economical use, and that the Great Lakes would be tapped at too great expense. Several stations for gauging were established in 1901, and furnished the data for this paper. The stations and streams were as follows

(all in New York except one): Dover Plains, on Tenmile River; Gaylordsville, Conn., on the Housatonic; South Cairo, on Catskill Creek; Kingston, on Esopus Creek; New Paltz, on Wallkill River; Rosendale, on Rondout Creek, and Glenham, on Fishkill Creek.

Observations on the height of the water were made twice each day and current-meter measurements at frequent intervals. These observations supply data for computing the annual flow, and with accompanying maps for determining sites of needed reservoirs. Methods of finding velocity are described, including the use of current-meters, surface and sub-surface floats, and weirs or dams. The last, already in existence for other purposes, often supply a convenient means of computing the discharge. Both the methods and the results may be considered as typical of the work performed by the Survey in all parts of the United States and serving the needs of those who use power or seek for water supply.

The report also gives studies of turbidity and colour, the latter being mainly due to vegetable matter in solution. The waters of New England and New York are little turbid as compared with those of the South Atlantic States or those of the Ohio and Mississippi Rivers. The turbidity determines the amount of coagulant needed in filters and the size of reservoirs needed to supply clear waters in periods when the rivers are carrying a large body of land waste. Detailed tables show turbidity, colour, alkalinity, hardness, and discharge per second for the several streams.

Paper No. 79 in the same series is by M. O. Leighton, and bears the title Normal and Polluted Waters in Northeastern United States. Rivers vary in the purposes for which they are of most value. Some streams are worth more for carrying away the refuse of manufacture than they could be for harvesting ice or for fishing grounds. The Merrimac, which is first studied, has small value for transportation, is famous for power, and has important ice fields about its upper waters. This river, as a whole, has been studied more carefully, in the author's opinion, than any other river in the world. Pollution of the lower river has been serious, and has taught costly lessons, particularly in Lowell and Lawrence. There, as commonly, the loss entailed was far beyond the cost of prevention. An interesting contrast appears between two tributaries—namely, the Sudbury and the Assabet, forming the Concord. Both basins are thickly populated; but the waters of the former are nearly normal, because the large towns are on the edge of the basin and do not befoul its waters with their sewage. The Assabet

waters, on the contrary, are polluted beyond the point of safe domestic use.

The Blackstone is *the most polluted river in New England*, occupying a densely-populated valley, and receiving, besides the ordinary sewage, a vast volume of manufacturing waste. The waters sometimes show an acid reaction. The conditions are worse because a great city, Worcester, begins the pollution almost at the source. Still, the value of the river for power more than compensates the loss in other directions.

The Connecticut, up to Hartford, is valuable for transportation. The aggregate power is enormous, and is far short of being utilized, although the power at Holyoke is the largest in this country, except Niagara. The value of the river down to the Massachusetts line is unimpaired for water supply and for ice, but in Massachusetts pollution becomes serious. This does not hold of the western tributaries in that State, the Deerfield and Westfield Rivers, which drain a mountainous and thinly-settled country. The policy of the State, however, is thorough, and warrants the expectation of improvement in the waters of the trunk stream.

The Housatonic is next described; and in this connection interesting extracts are given from decisions of the courts of Connecticut dealing with questions of water pollution, particularly between private riparian owners and cities and towns situated up the streams. The Delaware and the Ohio Rivers are embraced in this report, the latter in much detail. All the basins are illustrated by outline maps of the smaller component basins.

It is shown that, under some conditions of the Allegheny River, sewage poured in at Oil City would reach Pittsburg in fifteen hours, putting out of reckoning all question of "self-purification" between the two cities. Tests of the river water at Cincinnati in 1898 showed that the typhoid bacillus was probably always present. The observer, Mr. Fuller, states:

> From the evidence at hand it is probable that, by taking two cubic centimeters for each test, this germ would be found practically without exception. Upon taking one cubic centimeter for each test the identity of this bacillus was established in 60 per cent. of the samples, as shown by the results of tests.

These results follow in tabular form. The paper as a whole includes all the more important and available records of water examinations in this country, except those in connection with the Chicago Drainage Canal and the Illinois River.

Paper No. 72 in this series deals with Sewage Pollution in the Metropolitan Area near New York City, and is of intense practical

interest. The author is Mr. M. O. Leighton. It is a curious fact that the Raritan, except near its mouth, is quite free from pollution, and most of its tributaries offer safe water for use. The Passaic, on the other hand, is much the most valuable drainage system in New Jersey, and its waters reach in some cases the extreme of defilement. The river is described in detail as to profile, tributaries, amount of discharge, conditions of population, and resulting pollution. Under the last head the facts given are astonishing, and demand attention and action. Municipalities like Jersey City and Newark, which secured other water-supply at great expense, experienced immediate relief from the diseases incident to the use of contaminated water.

Fish have, for the most part, disappeared from the river. The stench arising from the stream, and from the foul matter lodged on its banks, has made parts of the river belt unhealthful and almost uninhabitable. The cities of Paterson, Passaic, Orange, and Newark, and many towns, discharge their sewage into the river. The Passaic Valley Sewerage Commissioners' report is quoted at some length, the extract closing as follows:

> In short, the pollution of the lower Passaic river appeared to the commissioners to be completely established as a public nuisance, an injury to health, and an increasing menace to property interests from the beginning at the Great Falls to below Newark.

The problem was taken up in 1899 by the State Sewerage Commission. Parts of their report show that the sewage is driven in and out along the lower river by the tides, effective flushing taking place only after large rainfall. People living a half mile away from the stream have been forced to close their windows to keep out the stench. Similar conditions were felt from Paterson to Newark Bay, and factory hands in Newark were repeatedly obliged to stop work.

Succeeding pages discuss the loss of values in water supply, ice, fish, and realty. Fixing a low-water rate, the value of the supply equals a principal of over eighteen millions of dollars, which, under existing conditions, is lost. It is partly offset, however, by uses for power. The greatest loss is in realty values. The author cites a 14-acre tract for which $40,000 was refused less than twenty years ago. This piece of land cannot be sold at any price.

The remainder of the paper is devoted to the Hudson and its branches. The reader must turn to the report itself for all but the barest summary. Below Poughkeepsie the water is affected by the salt; hence pollution occasions no loss. From Poughkeepsie to Troy the river is polluted, but its commercial value is more than

compensation. Conditions are not here growing worse, for population is scarcely increasing. There is rapid growth, however, above Troy, both along the main stream and on the Mohawk. These parts are of value for power, water supply, and ice. The Hoosick offers a case of inter-State complications, owing, especially, to the pollution of its headwaters at North Adams. In fact, the waters of this stream are worse where they cross the New York and Vermont line than when they enter the Hudson. The Mohawk, from Rome to its mouth, offers a belt of great increase of population and of serious pollution. Schenectady has abandoned its intakes from the river; but Cohoes, which is below the entire population of this thronged valley, *is still contented to drink from the cesspool of its neighbours.* This is a more aggravated case than that of Troy, which is slowly learning the lesson, but furnished ground for the remark by a sanitary expert before a Senate Committee in the District of Columbia that *up in Troy anything short of soup would be satisfactory.*

The question of pollution is of vast importance in the case of the Hudson, as a source of ice and a possible source of water for Greater New York. Indeed, Mr. James H. Fuertes, in an investigation following the Ramapo job, favoured the adoption of the river supply to be taken out above Poughkeepsie. Other recent titles in the water-supply series are: The Motions of Underground Waters, No. 67; Water Powers of the State of Maine, No. 69; Irrigation Systems of Texas, No. 71; Water Resources of the State of Colorado, No. 74; and Preliminary Report on Artesian Basins in Southwestern Idaho and Southeastern Oregon, No. 78.

Bulletin 213 of the Survey embraces Contributions to Economic Geology, by various authors. Several recently-exploited petroleum fields are here described, including, first, those of California, which are mainly south of the latitude of San Francisco. They lie in the central valley of the State, within the Coast Range, and along the Pacific front. Details of the several districts are given. Of these the Kern River field is the most productive. It is shown in general for the oils of the State that they are developed in strata of late geological age which have been subjected to folding and in some cases to faulting. The total thickness of these beds is at least 20,000 feet, carrying ten or twelve oil horizons. Conditions warrant the expectation that other fields will be discovered, but the supply is plainly exhaustible.

Another of the newer fields is in the neighbourhood of Boulder, in Colorado. This is reported by Professor N. M. Fenneman of

the University of Colorado. Oil springs, due to seepage, have been known for more than thirty years. The first oil was struck in January, 1902. The oil lies in slightly gritty layers of Pierre shale, which often would not be called a "sand" but for the presence of the oil. There is little correlation of the sands at definite levels; hence it would not seem to be possible to predict horizons at which the product is likely to occur. No stratum has been proved to extend for a half mile. "Shooting" has been beneficial in some cases but harmful in others. Eighty-two wells have been sunk to considerable depths in the central and chief part of the field, and thirteen pumps are working regularly. At the time of writing there was daily shipment of two hundred barrels of crude oil. It will thus be seen that the output of the region is as yet relatively small.

Far more extensive are the oil resources of the Texas–Louisiana Gulf Coastal Plain, here reported by Mr. C. W. Hayes. The account is brief, being an advance summary of a Survey Bulletin now in press. The region included is a belt 50 to 75 miles in width, reaching from near the Mississippi River in Louisiana two-thirds across the State of Texas. As in the Boulder field, there is no observed continuity of oil-bearing strata. Small local domes exist in the beds, due to some form of vertical uplift. The oil is associated with these, and they reveal themselves in low hills or broad surface swells. The "pools" are small as compared with central Texas or the Appalachians. Oil was discovered in January, 1901, and within a year and a half there were 280 wells producing from the Spindletop pool at Beaumont. This pool is limited to about 200 acres; and it is suggested that a few well-placed wells would have tapped the supply quite as effectively, and at great saving of expense. Like the oil and gas reservoirs of Ohio and Indiana, the oil rock is a porous crystalline dolomite. The porosity is greater here than in the more northern States, and includes distinct cavities an inch or more across. The author estimates that one-third of the space is occupied by cavities, which means large storage and early exhaustion as well.

"Gushing" is a characteristic feature of the Gulf region, and is due to the expansive force of pent-up gases. The pressure has greatly declined; hence spontaneous flow is followed by pumping, which, in turn, will become unprofitable. In quality the oil resembles that of California rather than that from the Appalachians, and will be used mainly for fuel, having some advantages over coal, especially for locomotives.

Bulletin No. 209 discusses the geology of Ascutney Mountain, Vermont. This is hardly a locality of general geographic interest, and most of the Bulletin is occupied with petrographic and structural facts which have no place here; but the author, Dr. R. A. Daly, draws the interesting conclusion that no such powerful glacial erosions took place in New England as has been proved for the fiord region of Norway or the valleys of Switzerland. Mount Ascutney has no definite stoss-and-lee form, its radiating ravines are deep and of pre-glacial origin, and the "pre-glacial Ascutney had practically the form of the present mountain." That glacial erosion should be large under some conditions and small in others is rational, and helps to explain the opposing verdicts of different observers. What we need is a precise knowledge of these conditions.

The latest volume of Mineral Resources of the United States covers the year 1901. Instead of appearing according to the custom of later years, as part of the Director's annual report, it now stands by itself and goes back to the ordinary octavo form. It is compiled by David T. Day, Chief of Division of Mining and Mineral Resources, and contains 996 pages, giving in text and tabular form brief reviews of all mineral products of the United States.

Of the new series of Professional Papers about a dozen have been received. Nos. 1 and 2 form additions to the already considerable body of Survey literature dealing with Alaska. No. 3 is a detailed report on the Geology and Petrography of the Crater Lake National Park, the senior author being Mr. J. S. Diller, who has already given us briefer but excellent accounts of this now famous region. Papers 4 to 9 deal with forest conditions in various parts of Washington, Oregon, and California. Some of these are lavishly illustrated, and contain a large amount of detailed information. Paper No. 10 belongs also to Alaska; and No. 14 is a somewhat bulky volume, giving a summary of chemical analyses of igneous rocks.

The Twenty-second Annual Report of the Geological Survey is the last to be issued in the old form, containing not only the usual administrative report of the Director, but several bound volumes, mainly of economic material, such as is now appearing under the general title of Professional Papers. Volume 1 contains the Director's Report; and this is followed by Mr. Geo. H. Eldridge in a review of the Asphalt and Bituminous Rock Deposits of the United States. To the average reader the great variety and the wide distribution of the hydrocarbons as a whole will be surprising. They may be gaseous; or fluid, like petroleum; or viscous, like mineral

tar; and thus the conditions pass to elastic, or solid. In their occurrence they may be mixed with limestone, with silica, or sand, or with earthy matter. Many analyses are given, and the inter-gradations and the difficulty of classifications are emphasized. The distribution is described and also delineated upon a map. In one form or another this class of products appears in West Virginia and Kentucky, east of the Mississippi River, and in Arkansas, Indian Territory, Missouri, Texas, Utah, and California, with minor occurences in other States. The localities are then described in detail, with many maps, sections, and views.

Volume 2 contains 888 pages, and is entirely devoted to various ore deposits, containing little that is of general geographical interest. Volume 3 is mainly taken up with a comprehensive review of the coal fields of the United States. Being the latest extended publication on this subject, it has much value as a work of reference, not only from the economic point of view, but also for teachers. Mr. C. W. Hayes gives a brief general introduction, and Professor J. B. Woodworth presents the first in the series of papers—an account of the coal beds of Triassic age, in the Eastern United States, in Virginia and North Carolina. This coal has long been known, and was mined as early as 1775; but it has been so overshadowed by the great Appalachian deposits of Carboniferous age that this Report and even the existence of such coals would be a surprise to most non-geological readers. In pursuance of the general object, to make this Report a complete and trustworthy summary, the other papers, like the first, are prepared by special students of the several fields. The reader is referred to the volume itself for titles, authors, and the great body of facts which can receive no notice here. The same volume includes reports on the Gaines oil field of Northern Pennsylvania, on the Portland Cement Industry in Michigan, and on the chalk of Southwestern Arkansas.

Volume 4 gives 500 pages to the results of stream measurement for 1900. This work is done under the direction of Mr. F. H. Newell, Hydrographer-in-Charge. In the same general field is the report that follows; it is by Mr. Arthur P. Davis, and discusses the Hydrography of the American Isthmus. The author begins with a summary account of the physiography of the isthmus. Temperature and humidity of various stations are given, with rainfall and wind movement. A brief notice is then given of the several canal routes—the Atrato, the San Blas, the Caledonia, the Panama, and the Nicaragua. A comparison of routes makes some interesting parallels, with data from Manchester, Suez, Kiel, and Sault Ste.

Marie. According to our author, no trade between Europe and the Orient will use an American canal, owing to the shorter distance by the Suez route; and even vessels from New York, headed to points south of Hong Kong, will go by Suez or the Cape of Good Hope.

The comparison between Panama and Nicaragua is not without interest, in the uncertainty which still exists. Nicaragua, being in the belt of trade winds, is more favourable for sailing craft; but the proportion of this class of vessels is small, and is likely to be smaller in the near future. Nicaragua would be chosen by sailing ships from the North, about 5 per cent. of the total traffic. Steam vessels from Gulf ports would have little choice between the two routes in reaching the west coast of North America. All others, or 70 per cent. of the whole, would prefer Panama. Steam vessels going to the west coast of South America would save nearly 400 miles by this route. Panama, on the other hand, is unhealthful; while Nicaragua is favourable in this regard, and is itself a region of vast undeveloped resources. This land is the most favourable anywhere to be found in the tropical belt of the world for Caucasian immigration. The opportunity to surround the canal with civilized life of a high type does not exist at Panama. The hydrography of both routes is then studied in detail.

This volume closes with a supplemental report on the High Plains and their Utilization, by Willard D. Johnson. The main body of this report was offered in the 21st Annual, and was reviewed by the present writer in an earlier number of this BULLETIN.

The twenty-third Annual Report of the Survey is the first to be published under the new plan. It is a single volume, giving the administrative report upon work done in the year ending June 30, 1902. The Director gives a short historical account of the growth of the new legislation concerning the arid lands, beginning with Major Powell's well-known report, which was prepared in 1877 and 1878, and coming down to the time when the President's distinctly-affirmed policy and the action of Congress have both expressed and strengthened the popular interest in this question.

As usual, the work of the numerous field parties is briefly described; and it is stated that Mr. C. W. Hayes has assumed the position of Geologist-in-Charge of Geology, and Mr. A. H. Brooks, after wide experience in Alaskan work, has been placed in charge of investigations in that increasingly-important region. There is a résumé of mineral resources, and the progress of the topographic department is given in detail, with progress maps for all parts of

the Territory. The report closes with a memorial of Clarence King (including portrait), Director of the Fortieth Parallel Survey, and first Director of the United States Geological Survey under the present organization. A. P. B.

MR. PEARY'S EXPEDITION TO THE ARCTIC.

Mr. Peary has obtained a three years' leave of absence from the Navy Department, to begin from April 1, 1904. The purpose is to enable him "to undertake an expedition for the attainment of the north pole and to secure general scientific and geographical information concerning the high polar regions." Mr. Peary sent to the Secretary of the Navy, with his application, the following letter explaining his plans:

WASHINGTON, D. C., Sept. 2, 1903.

SIR: Referring to my application for leave of absence accompanying this, I beg to state for your information that I propose to secure a suitable ship, put her into one of our best shipyards, have her reënforced and strengthened to the maximum degree and fitted with American engines, possessing the maximum of strength and power with the minimum weight and space, so that she may go north as an exponent of American skill and mechanical ability.

With such ship I should sail north about the 1st of next July, and on reaching the Whale Sound region should take on board my Esquimaux, establish my permanent sub-base at Cape Sabine, and then force my way northward to my proposed winter quarters on the northern shore of Grant Land, establishing caches as far as practicable *en route*. By the earliest returning light of the following February I should start due north over the polar pack with a small, light pioneer party, followed by a large, heavy main party. I should expect to accomplish the distance to the pole and return in about one hundred days or a little more, an average travel of about ten miles a day. Returning, I should break the ship out late in the same season and return home.

If ice conditions the first year were such as to prevent reaching the northern shore of Grant Land, I should winter as far north as practicable and force the ship to the desired location the following year. In this event the expedition would be gone two years.

This plan is the result of some twelve years of almost continuous experience in those latitudes, and is based upon an extended personal acquaintance with the region from Sabine to 84 degrees north latitude and a thorough familiarity with climatic and other conditions and with Esquimaux.

The distinctive features of my plan are: The use of individual sledges with comparatively light loads, drawn by dogs, giving a travelling unit of high speed and radius of reach, as opposed to the man sledge, with its heavy load, slow speed and limited radius; the adoption of Esquimaux methods and costume and the fullest utilization of the Esquimaux themselves.